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# 1.Ecology

**Ecology** (from [Greek](https://en.wikipedia.org/wiki/Greek_language): οἶκος, "house", or "environment"; -λογία, "study of")[[A]](https://en.wikipedia.org/wiki/Ecology#cnote_A) is the branch of [biology](https://en.wikipedia.org/wiki/Biology)[[1]](https://en.wikipedia.org/wiki/Ecology#cite_note-1) which studies the interactions among organisms and their environment. Objects of study include interactions of [organisms](https://en.wikipedia.org/wiki/Organism) with each other and with [abiotic components](https://en.wikipedia.org/wiki/Abiotic_component) of their [environment](https://en.wikipedia.org/wiki/Environment_(biophysical)). Topics of interest include the [biodiversity](https://en.wikipedia.org/wiki/Biodiversity), distribution, [biomass](https://en.wikipedia.org/wiki/Biomass_(ecology)), and [populations](https://en.wikipedia.org/wiki/Population) of organisms, as well as cooperation and competition within and between [species](https://en.wikipedia.org/wiki/Species). [Ecosystems](https://en.wikipedia.org/wiki/Ecosystems) are dynamically interacting systems of [organisms](https://en.wikipedia.org/wiki/Organisms), the [communities](https://en.wikipedia.org/wiki/Community_(ecology)) they make up, and the non-living components of their environment. Ecosystem processes, such as [primary production](https://en.wikipedia.org/wiki/Primary_production), [pedogenesis](https://en.wikipedia.org/wiki/Pedogenesis), [nutrient cycling](https://en.wikipedia.org/wiki/Nutrient_cycling), and [niche construction](https://en.wikipedia.org/wiki/Niche_construction), regulate the flux of energy and matter through an environment. These processes are sustained by organisms with specific life history traits. Biodiversity means the varieties of [species](https://en.wikipedia.org/wiki/Species), [genes](https://en.wikipedia.org/wiki/Gene), and [ecosystems](https://en.wikipedia.org/wiki/Ecosystem), enhances certain [ecosystem services](https://en.wikipedia.org/wiki/Ecosystem_services).

Ecology is not synonymous with [environmentalism](https://en.wikipedia.org/wiki/Environmentalism), natural history, or [environmental science](https://en.wikipedia.org/wiki/Environmental_science). It overlaps with the closely related sciences of [evolutionary biology](https://en.wikipedia.org/wiki/Evolutionary_biology), [genetics](https://en.wikipedia.org/wiki/Genetics), and [ethology](https://en.wikipedia.org/wiki/Ethology). An important focus for ecologists is to improve the understanding of how biodiversity affects ecological function. Ecologists seek to explain:

* Life processes, interactions, and [adaptations](https://en.wikipedia.org/wiki/Adaptations)
* The movement of materials and [energy](https://en.wikipedia.org/wiki/Energy) through living communities
* The [successional](https://en.wikipedia.org/wiki/Ecological_succession) development of ecosystems
* The [abundance](https://en.wikipedia.org/wiki/Abundance_(ecology)) and distribution of organisms and biodiversity in the context of the [environment](https://en.wikipedia.org/wiki/Environment_(biophysical)).

#### Soils[[edit](https://en.wikipedia.org/w/index.php?title=Ecology&action=edit&section=39)]

*Main article:*[*Soil ecology*](https://en.wikipedia.org/wiki/Soil_ecology)

Soil is the living top layer of mineral and organic dirt that covers the surface of the planet. It is the chief organizing centre of most ecosystem functions, and it is of critical importance in agricultural science and ecology. The [decomposition](https://en.wikipedia.org/wiki/Decomposition) of dead organic matter (for example, leaves on the forest floor), results in soils containing [minerals](https://en.wikipedia.org/wiki/Minerals) and nutrients that feed into plant production. The whole of the planet's soil ecosystems is called the [pedosphere](https://en.wikipedia.org/wiki/Pedosphere) where a large biomass of the Earth's biodiversity organizes into trophic levels. Invertebrates that feed and shred larger leaves, for example, create smaller bits for smaller organisms in the feeding chain. Collectively, these organisms are the [detritivores](https://en.wikipedia.org/wiki/Detritivore) that regulate soil formation.[[207]](https://en.wikipedia.org/wiki/Ecology#cite_note-Coleman04-207)[[208]](https://en.wikipedia.org/wiki/Ecology#cite_note-Wilkinson09-208) Tree roots, fungi, bacteria, worms, ants, beetles, centipedes, spiders, mammals, birds, reptiles, amphibians, and other less familiar creatures all work to create the trophic web of life in soil ecosystems. Soils form composite phenotypes where inorganic matter is enveloped into the physiology of a whole community. As organisms feed and migrate through soils they physically displace materials, an ecological process called [bioturbation](https://en.wikipedia.org/wiki/Bioturbation). This aerates soils and stimulates heterotrophic growth and production. Soil [microorganisms](https://en.wikipedia.org/wiki/Microorganisms) are influenced by and feed back into the trophic dynamics of the ecosystem. No single axis of causality can be discerned to segregate the biological from geomorphological systems in soils.[[209]](https://en.wikipedia.org/wiki/Ecology#cite_note-Phillips09-209)[[210]](https://en.wikipedia.org/wiki/Ecology#cite_note-Reinhard10-210) [Paleoecological](https://en.wikipedia.org/wiki/Paleoecology) studies of soils places the origin for bioturbation to a time before the Cambrian period. Other events, such as the [evolution of trees](https://en.wikipedia.org/wiki/Tree#Evolutionary_history) and the [colonization of land](https://en.wikipedia.org/wiki/Evolutionary_history_of_life#Colonization_of_land) in the Devonian period played a significant role in the early development of ecological trophism in soils.

# 2.Levels, scope, and scale of organization[[edit](https://en.wikipedia.org/w/index.php?title=Ecology&action=edit&section=1)]

The scope of ecology contains a wide array of interacting levels of organization spanning micro-level (e.g., [cells](https://en.wikipedia.org/wiki/Cell_(biology))) to a planetary scale (e.g., [biosphere](https://en.wikipedia.org/wiki/Earth%27s_spheres)) [phenomena](https://en.wikipedia.org/wiki/Phenomena). Ecosystems, for example, contain abiotic [resources](https://en.wikipedia.org/wiki/Resource_(biology)) and interacting life forms (i.e., individual organisms that aggregate into [populations](https://en.wikipedia.org/wiki/Population) which aggregate into distinct ecological communities). Ecosystems are dynamic, they do not always follow a linear successional path, but they are always changing, sometimes rapidly and sometimes so slowly that it can take thousands of years for ecological processes to bring about certain [successional stages](https://en.wikipedia.org/wiki/Ecological_succession) of a forest. An ecosystem's area can vary greatly, from tiny to vast. A single tree is of little consequence to the classification of a forest ecosystem, but critically relevant to organisms living in and on it.[[3]](https://en.wikipedia.org/wiki/Ecology#cite_note-Stadler98-3) Several generations of an [aphid](https://en.wikipedia.org/wiki/Aphid) population can exist over the lifespan of a single leaf. Each of those aphids, in turn, support diverse [bacterial](https://en.wikipedia.org/wiki/Bacteria) communities.[[4]](https://en.wikipedia.org/wiki/Ecology#cite_note-Humphreys97-4) The nature of connections in ecological communities cannot be explained by knowing the details of each species in isolation, because the emergent pattern is neither revealed nor predicted until the ecosystem is studied as an integrated whole.[[5]](https://en.wikipedia.org/wiki/Ecology#cite_note-Liere2012-5) Some ecological principles, however, do exhibit collective properties where the sum of the components explain the properties of the whole, such as birth rates of a population being equal to the sum of individual births over a designated time frame.[[6]](https://en.wikipedia.org/wiki/Ecology#cite_note-Odum05-6)

**Hierarchy**[[edit](https://en.wikipedia.org/w/index.php?title=Ecology&action=edit&section=2)]

*See also:*[*Biological organisation*](https://en.wikipedia.org/wiki/Biological_organisation)*and*[*Biological classification*](https://en.wikipedia.org/wiki/Biological_classification)

System behaviors must first be arrayed into different levels of organization. Behaviors corresponding to higher levels occur at slow rates. Conversely, lower organizational levels exhibit rapid rates. For example, individual tree leaves respond rapidly to momentary changes in light intensity, CO2 concentration, and the like. The growth of the tree responds more slowly and integrates these short-term changes.

*O'Neill et al. (1986)*[[7]](https://en.wikipedia.org/wiki/Ecology#cite_note-O'Neill86-7):76

The scale of ecological dynamics can operate like a closed system, such as aphids migrating on a single tree, while at the same time remain open with regard to broader scale influences, such as atmosphere or climate. Hence, ecologists classify [ecosystems](https://en.wikipedia.org/wiki/Ecosystems) hierarchically by analyzing data collected from finer scale units, such as vegetation associations, climate, and soil types, and integrate this information to identify emergent patterns of uniform organization and processes that operate on local to regional, [landscape](https://en.wikipedia.org/wiki/Landscape), and chronological scales.

To structure the study of ecology into a conceptually manageable framework, the biological world is organized into a [nested hierarchy](https://en.wikipedia.org/wiki/Biological_classification), ranging in scale from [genes](https://en.wikipedia.org/wiki/Gene), to [cells](https://en.wikipedia.org/wiki/Cell_(biology)), to [tissues](https://en.wikipedia.org/wiki/Tissue_(biology)), to [organs](https://en.wikipedia.org/wiki/Organ_(anatomy)), to [organisms](https://en.wikipedia.org/wiki/Organism), to [species](https://en.wikipedia.org/wiki/Species), to [populations](https://en.wikipedia.org/wiki/Population_ecology), to [communities](https://en.wikipedia.org/wiki/Community_(ecology)), to [ecosystems](https://en.wikipedia.org/wiki/Ecosystem), to [biomes](https://en.wikipedia.org/wiki/Biome), and up to the level of the [biosphere](https://en.wikipedia.org/wiki/Biosphere).[[8]](https://en.wikipedia.org/wiki/Ecology#cite_note-Nachtomy01-8) This framework forms a [panarchy](https://en.wikipedia.org/wiki/Panarchy)[[9]](https://en.wikipedia.org/wiki/Ecology#cite_note-Holling01-9) and exhibits [non-linear](https://en.wikipedia.org/wiki/Non-linear)behaviors; this means that "effect and cause are disproportionate, so that small changes to critical variables, such as the number of [nitrogen fixers](https://en.wikipedia.org/wiki/Nitrogen_fixation), can lead to disproportionate, perhaps irreversible, changes in the system properties."[[10]](https://en.wikipedia.org/wiki/Ecology#cite_note-Levin99-10):14

# 3.Ecological complexity[[edit](https://en.wikipedia.org/w/index.php?title=Ecology&action=edit&section=17)]

*Main article:*[*Complexity*](https://en.wikipedia.org/wiki/Complexity)

*See also:*[*Emergence*](https://en.wikipedia.org/wiki/Emergence)

Complexity is understood as a large computational effort needed to piece together numerous interacting parts exceeding the iterative memory capacity of the human mind. Global patterns of biological diversity are complex. This [biocomplexity](https://en.wikipedia.org/wiki/Biocomplexity) stems from the interplay among ecological processes that operate and influence patterns at different scales that grade into each other, such as transitional areas or [ecotones](https://en.wikipedia.org/wiki/Ecotones) spanning landscapes. Complexity stems from the interplay among levels of biological organization as energy, and matter is integrated into larger units that superimpose onto the smaller parts. "What were wholes on one level become parts on a higher one."[[95]](https://en.wikipedia.org/wiki/Ecology#cite_note-Novikoff45-95):209 Small scale patterns do not necessarily explain large scale phenomena, otherwise captured in the expression (coined by Aristotle) 'the sum is greater than the parts'.[[96]](https://en.wikipedia.org/wiki/Ecology#cite_note-Schneider01-96)[[97]](https://en.wikipedia.org/wiki/Ecology#cite_note-Molnar04-97)[[E]](https://en.wikipedia.org/wiki/Ecology#cnote_E)

"Complexity in ecology is of at least six distinct types: spatial, temporal, structural, process, behavioral, and geometric."[[98]](https://en.wikipedia.org/wiki/Ecology#cite_note-Loehle04-98):3 From these principles, ecologists have identified [emergent](https://en.wikipedia.org/wiki/Emergence) and [self-organizing](https://en.wikipedia.org/wiki/Self-organization#Self-organization_in_biology) phenomena that operate at different environmental scales of influence, ranging from molecular to planetary, and these require different explanations at each integrative level.[[48]](https://en.wikipedia.org/wiki/Ecology#cite_note-Lovelock03-48)[[99]](https://en.wikipedia.org/wiki/Ecology#cite_note-Odum1977-99) Ecological complexity relates to the dynamic resilience of ecosystems that transition to multiple shifting steady-states directed by random fluctuations of history.[[9]](https://en.wikipedia.org/wiki/Ecology#cite_note-Holling01-9)[[100]](https://en.wikipedia.org/wiki/Ecology#cite_note-Carpenter01-100) Long-term ecological studies provide important track records to better understand the complexity and resilience of ecosystems over longer temporal and broader spatial scales. These studies are managed by the International Long Term Ecological Network (LTER).[[101]](https://en.wikipedia.org/wiki/Ecology#cite_note-urlWelcome_to_ILTER_%E2%80%94_ILTER-101) The longest experiment in existence is the [Park Grass Experiment](https://en.wikipedia.org/wiki/Park_Grass_Experiment), which was initiated in 1856.[[102]](https://en.wikipedia.org/wiki/Ecology#cite_note-Siverton06-102) Another example is the [Hubbard Brook study](https://en.wikipedia.org/wiki/Hubbard_Brook_Experimental_Forest), which has been in operation since 1960.[[103]](https://en.wikipedia.org/wiki/Ecology#cite_note-103)

**Holism**[[edit](https://en.wikipedia.org/w/index.php?title=Ecology&action=edit&section=18)]

*Main article:*[*Holism*](https://en.wikipedia.org/wiki/Holism)

Holism remains a critical part of the theoretical foundation in contemporary ecological studies. Holism addresses the [biological organization](https://en.wikipedia.org/wiki/Biological_organisation) of life that [self-organizes](https://en.wikipedia.org/wiki/Systems_biology) into layers of emergent whole systems that function according to non-reducible properties. This means that higher order patterns of a whole functional system, such as an [ecosystem](https://en.wikipedia.org/wiki/Ecosystem), cannot be predicted or understood by a simple summation of the parts.[[104]](https://en.wikipedia.org/wiki/Ecology#cite_note-Liu09-104) "New properties emerge because the components interact, not because the basic nature of the components is changed."[[6]](https://en.wikipedia.org/wiki/Ecology#cite_note-Odum05-6):8 Ecological studies are necessarily holistic as opposed to [reductionistic](https://en.wikipedia.org/wiki/Reductionistic).[[36]](https://en.wikipedia.org/wiki/Ecology#cite_note-Levins80-36)[[99]](https://en.wikipedia.org/wiki/Ecology#cite_note-Odum1977-99)[[105]](https://en.wikipedia.org/wiki/Ecology#cite_note-Mikkelson10-105) Holism has three scientific meanings or uses that identify with ecology: 1) the mechanistic complexity of ecosystems, 2) the practical description of patterns in quantitative reductionist terms where correlations may be identified but nothing is understood about the causal relations without reference to the whole system, which leads to 3) a [metaphysical](https://en.wikipedia.org/wiki/Metaphysics) hierarchy whereby the causal relations of larger systems are understood without reference to the smaller parts. Scientific holism differs from [mysticism](https://en.wikipedia.org/wiki/Mysticism) that has appropriated the same term. An example of metaphysical holism is identified in the trend of increased exterior thickness in shells of different species. The reason for a thickness increase can be understood through reference to principles of natural selection via predation without need to reference or understand the [biomolecular](https://en.wikipedia.org/wiki/Biomolecular) properties of the exterior shells.

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| Complex Table (Less accessible)  **Class Schedule**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Lesson | Topic | Assignment | Points | DUE | | 1 | What is distance Learning? | WiKi #1 | 10 | March 10 | | Presentation | 20 |  | | 2 | History & Theories | Brief Paper | 20 | March 24 | | Spring Break0 | | | | | | 3 | Distance Learners | Discussion #1 | 10 | April 7 | | Group Project | 50 | April 14 | | 4 | Media Selection | Blog #1 | 10 | April 21 | |

# lifecycle_apple.gif4.Relation to evolution[[edit](https://en.wikipedia.org/w/index.php?title=Ecology&action=edit&section=19)]

Ecology and evolutionary biology are considered sister disciplines of the life sciences. [Natural selection](https://en.wikipedia.org/wiki/Natural_selection), [life history](https://en.wikipedia.org/wiki/Biological_life_cycle), [development](https://en.wikipedia.org/wiki/Developmental_biology), [adaptation](https://en.wikipedia.org/wiki/Adaptation), [populations](https://en.wikipedia.org/wiki/Populations), and [inheritance](https://en.wikipedia.org/wiki/Heredity) are examples of concepts that thread equally into ecological and evolutionary theory. Morphological, behavioural, and genetic traits, for example, can be mapped onto evolutionary trees to study the historical development of a species in relation to their functions and roles in different ecological circumstances. In this framework, the analytical tools of ecologists and evolutionists overlap as they organize, classify, and investigate life through common systematic principals, such as [phylogenetics](https://en.wikipedia.org/wiki/Phylogenetics) or the [Linnaean system of taxonomy](https://en.wikipedia.org/wiki/Linnaean_taxonomy).[[107]](https://en.wikipedia.org/wiki/Ecology#cite_note-Miles93-107)The two disciplines often appear together, such as in the title of the journal [*Trends in Ecology and Evolution*](https://en.wikipedia.org/wiki/Trends_in_Ecology_and_Evolution).[[108]](https://en.wikipedia.org/wiki/Ecology#cite_note-TREE-108) There is no sharp boundary separating ecology from evolution, and they differ more in their areas of applied focus. Both disciplines discover and explain emergent and unique properties and processes operating across different spatial or temporal scales of organization.[[36]](https://en.wikipedia.org/wiki/Ecology#cite_note-Levins80-36)[[48]](https://en.wikipedia.org/wiki/Ecology#cite_note-Lovelock03-48) While the boundary between ecology and evolution is not always clear, ecologists study the abiotic and biotic factors that influence evolutionary processes,[[109]](https://en.wikipedia.org/wiki/Ecology#cite_note-Allee49-109)[[110]](https://en.wikipedia.org/wiki/Ecology#cite_note-Ricklefs96-110) and evolution can be rapid, occurring on ecological timescales as short as one generation.

### Cognitive ecology[[edit](https://en.wikipedia.org/w/index.php?title=Ecology&action=edit&section=21)]

Cognitive ecology integrates theory and observations from [evolutionary ecology](https://en.wikipedia.org/wiki/Evolutionary_ecology) and [neurobiology](https://en.wikipedia.org/wiki/Neurobiology), primarily [cognitive science](https://en.wikipedia.org/wiki/Cognitive_science), in order to understand the effect that animal interaction with their habitat has on their cognitive systems and how those systems restrict behavior within an ecological and evolutionary framework.[[128]](https://en.wikipedia.org/wiki/Ecology#cite_note-Palacios-128) "Until recently, however, cognitive scientists have not paid sufficient attention to the fundamental fact that cognitive traits evolved under particular natural settings. With consideration of the selection pressure on cognition, cognitive ecology can contribute intellectual coherence to the multidisciplinary study of cognition."[[129]](https://en.wikipedia.org/wiki/Ecology#cite_note-Dukas-129)[[130]](https://en.wikipedia.org/wiki/Ecology#cite_note-Dukas2-130) As a study involving the 'coupling' or interactions between organism and environment, cognitive ecology is closely related to [enactivism](https://en.wikipedia.org/wiki/Enactivism),[[128]](https://en.wikipedia.org/wiki/Ecology#cite_note-Palacios-128) a field based upon the view that "...we must see the organism and environment as bound together in reciprocal specification and selection..."

# 5.Relation to the environment[[edit](https://en.wikipedia.org/w/index.php?title=Ecology&action=edit&section=29)]

*Main article:*[*Natural environment*](https://en.wikipedia.org/wiki/Natural_environment)

The environment of ecosystems includes both physical parameters and biotic attributes. It is dynamically interlinked, and contains [resources](https://en.wikipedia.org/wiki/Resource_(biology)) for organisms at any time throughout their life cycle.[[6]](https://en.wikipedia.org/wiki/Ecology#cite_note-Odum05-6)[[166]](https://en.wikipedia.org/wiki/Ecology#cite_note-Mason57-166) Like ecology, the term environment has different conceptual meanings and overlaps with the concept of nature. Environment "includes the physical world, the social world of human relations and the built world of human creation."[[167]](https://en.wikipedia.org/wiki/Ecology#cite_note-Kleese01-167):62 The physical environment is external to the level of biological organization under investigation, including [abiotic](https://en.wikipedia.org/wiki/Abiotic) factors such as temperature, radiation, light, chemistry, [climate](https://en.wikipedia.org/wiki/Climate) and geology. The biotic environment includes genes, cells, organisms, members of the same species ([conspecifics](https://en.wikipedia.org/wiki/Conspecific)) and other species that share a habitat.[[168]](https://en.wikipedia.org/wiki/Ecology#cite_note-Campbell06-168)

The distinction between external and internal environments, however, is an abstraction parsing life and environment into units or facts that are inseparable in reality. There is an interpenetration of cause and effect between the environment and life. The laws of [thermodynamics](https://en.wikipedia.org/wiki/Thermodynamics), for example, apply to ecology by means of its physical state. With an understanding of metabolic and thermodynamic principles, a complete accounting of energy and material flow can be traced through an ecosystem. In this way, the environmental and ecological relations are studied through reference to conceptually manageable and isolated [material](https://en.wikipedia.org/wiki/Materialism) parts. After the effective environmental components are understood through reference to their causes; however, they conceptually link back together as an integrated whole, or *holocoenotic* system as it was once called. This is known as the [dialectical](https://en.wikipedia.org/wiki/Dialectical) approach to ecology. The dialectical approach examines the parts, but integrates the organism and the environment into a dynamic whole (or [umwelt](https://en.wikipedia.org/wiki/Umwelt)). Change in one ecological or environmental factor can concurrently affect the dynamic state of an entire ecosystem.[[36]](https://en.wikipedia.org/wiki/Ecology#cite_note-Levins80-36)[[169]](https://en.wikipedia.org/wiki/Ecology#cite_note-Kormondy95-169)

**Disturbance and resilience**[[edit](https://en.wikipedia.org/w/index.php?title=Ecology&action=edit&section=30)]

*Main article:*[*Resilience (ecology)*](https://en.wikipedia.org/wiki/Resilience_(ecology))

Ecosystems are regularly confronted with natural environmental variations and disturbances over time and geographic space. A disturbance is any process that removes biomass from a community, such as a fire, flood, drought, or predation.[[170]](https://en.wikipedia.org/wiki/Ecology#cite_note-Hughes10-170) Disturbances occur over vastly different ranges in terms of magnitudes as well as distances and time periods,[[171]](https://en.wikipedia.org/wiki/Ecology#cite_note-Levin92-171) and are both the cause and product of natural fluctuations in death rates, species assemblages, and biomass densities within an ecological community. These disturbances create places of renewal where new directions emerge from the patchwork of natural experimentation and opportunity.[[170]](https://en.wikipedia.org/wiki/Ecology#cite_note-Hughes10-170)[[172]](https://en.wikipedia.org/wiki/Ecology#cite_note-Holling73-172)[[173]](https://en.wikipedia.org/wiki/Ecology#cite_note-Folke04-173) Ecological resilience is a cornerstone theory in ecosystem management. Biodiversity fuels the resilience of ecosystems acting as a kind of regenerative insurance.

# Η οικογένεια μου